PTO 05-3025

CY=FR DATE=19840525 KIND=A1
PN=2 536 320

IMPROVEMENTS TO ELECTRICAL WELDING APPARATUSES, IN PARTICULAR TO APPARATUSES USING A METAL FILLER WIRE
[PERFECTIONNEMENTS AUX APPAREILS DE SOUDAGE ELECTRIQUE, NOTAMMENT AUX APPAREILS UTILISANT UN FIL DE METAL D'APPORT]

ROBERT PRUNIER

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. April 2005

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(10):	FR
DOCUMENT NUMBER	(11):	2 536 320
DOCUMENT KIND	(12):	A1
PUBLICATION DATE	(43):	19840525
APPLICATION NUMBER	(21):	82 19707
APPLICATION DATE	(22):	19821124
INTERNATIONAL CLASSIFICATION	(51):	B 23 K 9/235
PRIORITY COUNTRY	(33):	NA
PRIORITY NUMBER	(31):	NA
PRIORITY DATE	(32):	NA
INVENTOR	(72):	ROBERT PRUNIER
APPLICANT	(71):	ROBERT PRUNIER
TITLE	(54):	IMPROVEMENTS TO ELECTRICAL WELDING APPARATUSES, IN PARTICULAR TO APPARATUSES USING A METAL FILLER WIRE
FOREIGN TITLE	[54A]:	PERFECTIONNEMENTS AUX APPAREILS DE SOUDAGE ELECTRIQUE, NOTAMMENT AUX APPAREILS UTILISANT UN FIL DE METAL D'APPORT

IMPROVEMENTS TO ELECTRICAL WELDING APPARATUSES, IN PARTICULAR TO APPARATUSES USING A METAL FILLER WIRE

1*

The invention relates to welding, and in particular to electric welding. Welding methods are known in which a filler wire is supplied in the area of the weld when it is being carried out, with the use of a pay-out reel connected to a torch. The end of the metal filler wire is positioned in the torch across from the weld to be produced. It is fused using an electrical arc formed between the end of the torch and the metallic part on which the weld is carried out. According to the procedures, the electric arc causing this fusion is generated using an electrode placed in the immediate area of the end of the metal filler wire or even the wire itself plays the role of electrode to carry the current feeding the arc.

Such welding machines are largely used to form regular weld beads under operating conditions that are sometimes difficult. They lend themselves to automation of the welding operations. They make it possible to carry out welding with metals that are difficult to use whether because their melting point is high or because there are incompatibilities on the chemical level between the parts to be soldered, or even because they are subject to chemical reactions with /2 the surrounding environment, in particular when they are brought to high temperature. In order to improve their performance, many welding machines are provided with nozzles to blow gas, which may be either inert or active, according to the desired conditions for carrying out

*Numbers in the margin indicate pagination in the foreign text.

the work, in the vicinity of the solder bath.

Due to the complexity of the facilities and the high degree of performance quality that is the goal, it is essential that the supply of the metal filler wire to the torch is ensured in a regular manner that is free of breakdowns. In practice, when using such machines, it can be confirmed that frequently the advance of the metal filler wire is carried out in an intermittent manner or even that the wire is subject to blockages. In addition, in particular in the case where the wire itself plays the role of electrode for formation of the electric arc, it is necessary to transmit very elevated current intensities to the end of this wire. This transmission is carried out by contact. It often happens that, due to the deterioration of the quality of this contact, an inadequate current will be transmitted or that other functional breakdown, such as adhesions, occur that disturb the regular function of the installation.

The invention proposes to eliminate this type of problem in an electric welding installation with metal filler wire.

It provides especially for allowing a more regular function of these installations by ensuring an advance, without breakdown, of the metal filler wire and for limiting machine shutdowns due to breakdowns.

According to another aspect, the invention also provides for improving the function of welding installations equipped with torches equipped with a cooling device. In this regard, the object is to improve the convenience of use of such installations and to diminish

burn-out breakdowns of the torches.

According to a first aspect of the invention, an electric /3
soldering machine is provided of the type comprising a torch that makes it possible to position one end of a metal filler wire across from a part to be machined and to cause its fusion in the area of the part to form a weld and a supply magazine of metal filler wire for the torch is provided. The machine is characterized, in particular, by a means for processing the surface of the wire between the supply magazine and the torch, in particular in view of carrying out cleaning, dust removal, degreasing and/or deoxidizing on it. According to a preferred embodiment, this processing means has an ultrasound cleaning device.

The invention is based on the observations of the requestor, who has recognized that numerous functional breakdowns in electrical welding machines with filler wire, and especially automatic machines, are caused by a poor condition of the wire surface. The metal filler wires used with these types of machine can be very different in function depending on the type of weld to be carried out. However, in numerous cases, the conditions of manufacturing of these wires itself implies that their external surface is greasy, i.e. gummy at the outlet of the manufacturing machine. In addition, these wires which are generally stored on bobbins, tend to unwind during transportation and storage while they are waiting to be used. The dust accumulates still more on their surfaces when the latter is adhesive. These wires can even accumulate soiling in the environment of the welding shop,

which may be dusty. Certain filler materials are also easily oxidized in air.

These imperfections in the surface condition of the metal filler wires are due to accumulations of material that require frequent cleaning to prevent friction and the risk of blocking in the flexible sheath that supplies the torch. In addition, the dust, accumulations /4 of grease or oxides are detrimental to good conduction of the arc supply current due to contact between the supply conductor and the wire.

The tests carried out by the requester have made it possible to confirm that the provision of a means for cleaning the surface of the wire before it goes into the torch and, preferably, in the case of torches mounted at the end of flexible shafts, before they go into the flexible shaft, making it possible to considerably decrease the functional breakdowns connected with the advance of the metal filler wire and its supply of electrical current. In this respect, an ultrasonic cleaning device has proven especially effective to eliminate the different causes of defects on the surface of the wires used. A device such as this also has the advantage of good ease of use. In one embodiment type, the wire passes into a liquid contained in an ultrasonic bath at the output of a pay-out reel. It is easy to start up this installation when a new wire bobbin is provided on the machine.

Ultrasonic cleaning devices are known that use relatively volatile liquids as cleaning agents and carry out a recovery of the

vapors that escape from the vat due to the effect of heating caused by the ultrasonic vibrations, this recuperation being carried out by a condensation of these vapors using a cooling group.

In the case of soldering machines equipped with liquid-cooled torches, it is then provided, according to an especially advantageous embodiment of the invention, to withdraw the calories from the torch refrigerant liquid coming from the latter, also with the cooling group ensuring condensation of the cleaning liquid vapors. /5

A remarkable advantage results, in particular, in the area of convenience of use of soldering machines with torch cooling. In fact, in the known installations, this cooling is usually ensured by a circulation of water in the torch. The hot water coming from the latter passes into a radiator that is cooled by the action of a fan causing a circulation of forced air on the surface of the radiator elements. Other than their lack of efficiency, these embodiments have the inconvenience of being very noisy. The operators of such machines thus have a tendency to limit the use of the cooling devices as much as possible. The risk of burn-out of the torches that sometimes operate at considerable amperages and can increasingly reach very high temperatures (up to 300 to 350°C at the end of the torch) and the risk of functional breakdowns multiplies.

In this respect, and according to a second aspect, the invention also provides for a device for cooling of a welding torch comprising circulation ducts for refrigerant liquid, such as water, in the torch and the means for connecting these ducts to the refrigerant liquid

cooling unit in the area of this torch, this device being characterized in that the cooling unit comprises a group for producing cold in a chamber in which the refrigerant liquid can be circulated.

Other explanations and the descriptions of an embodiment are given below, in a non-limiting manner, with reference to the attached drawing, on which the single figure schematically represents a soldering machine incorporating the principles of the invention.

In the single figure, a welding unit **10** comprises a carriage **12** /6 mounted on casters and connected to a welding torch **18** by a flexible shaft **16**. The torch comprises a nozzle **20**, of which the diameter is reduced in the direction of its opening **22**, for blowing gas into a soldering zone **24** in front of torch **18**. Coaxially to the nozzle **20** and on the inside of same, a contact tube **26** is mounted that is pierced by a duct in which a metal filler wire **28** can be advanced. The end **30** of same can be positioned with precision with respect to the weld **24** due to a contact tube **26**. The wire **28** is supplied with a strong electrical current by contact between the outer surface and the inner wall of the contact tube duct **26** in such a way as to allow the arcing of an electric arc **32** between the end **30** and the weld zone **34** arranged on a part to be machined. An appropriate potential difference is maintained between the end **30** and this part **34**. At its rear end, the contact tube **26** is fastened in the body **36** of the torch **18**, the body on which the nozzle **20** also depends. A spiral-shaped duct **38** is arranged in the body **36**, in which a refrigerant liquid can circulate in order to

maintain the temperature of the torch **18** within the appropriate limits in spite of the very high currents supplied to the contact tube **26** and the heat released by the arc **32**.

The body **36** of torch **18** is fastened at one end of the flexible shaft **16**, being connected at the other end with a vertical wall **40** of a chest **56** on the carriage **12**. For clarity of the explanations, the end **32** of the flexible shaft **16** has been shown at a slight distance from this wall. The flexible shaft **16** is made up by the meeting, on the inside of an appropriate shaft, of several conduits making it possible to ensure the routing of the metal filler wire **28** to the torch **18**, the supply of gas to the nozzle **20** and a circuit of supply and return of the refrigerant liquid circulating in the cooling duct **38**.

On the base of the carriage **12**, a compressor group **50** is mounted /7 for a refrigeration unit. This comprises a chamber **52** arranged above the group **50** and passed through by classic refrigeration hoses that are not shown, making it possible to withdraw the calories on the inside of this chamber. Above the cooling chamber **52**, on feet **54**, the chest **56** rests that comprises a supply and cleaning unit for the metal filler wire. The chest **56** is closed with an upper cover **58** that is articulated on hinges **60**. On the side of the chest **56**, an axle **62** is mounted that forms a support for a movable pay-out reel **64** on which the metal filler wire is wound. This bobbin can easily be changed to make it possible to carry out a different type of weld or, when it is

empty, for its replacement with a full bobbin. At the output of the pay-out reel **64**, the metal filler wire **28** passes through a guiding roller **66** and, from there, across a vertical wall **68** of an ultrasound bath **70** by way of a sealed hole **72**. In function, the inside of the bath **70** is filled with a liquid **74**, a space existing above this bath is filled with vapor from liquid **74**. This may consist of a usual industrial solvent, such as Freon, adapted to the ultrasound cleaning installations.

The wire **28** passes to the inside of the liquid **74** by following a trajectory that is slightly inclined from the bottom of the top and again crosses a wall **76** of the bath **70** through a sealed hole **78** in the direction of a driving mechanism **80** comprising several rollers controlled in a classic manner in the welding installations with metal support wire. At the output of the roller guiding device **80**, the wire **28** crosses the vertical wall **40** of the carriage **56** through a protective ring **82** before penetrating to the inside of the flexible shaft **16**.

The bath **70** is formed on its upper part by a wall **84** in which two pipe connectors **86** and **88** are mounted. The connector **86** is connected by a pipe **90** to a coiled pipe on the inside of the cooling chamber **52**. At the outlet of this chamber, it is connected in a contiguous /8 chamber **94**, to the aspiration inlet **96** of a pump **98**. The supply outlet **100** of the pump **98** is connected by a pipe **102** to the pipe connection **88** at the top of the ultrasound cleaning bath **70**.

In the chamber **52**, another pipe coil **106** is provided, of which one end is connected to the supply outlet **108** of a pump **110** placed in a compartment **112** close to the chamber **52** below the compartment **94**. The other end **116** of the coil pipe **106** is connected at the output of the refrigeration chamber by a pipe **118** to a connector **120** for one of the ends of the supply and return circuits of the refrigerant liquid in the flexible shaft **16**. The other end of the circuit is connected by way of a connector **122** to a tank **124** in the compartment **112** by way of a hot water return pipe **126**. A plunger tube **128**, penetrating into the tank **124** is connected to the suction inlet **130** of the pump **110**.

In function, the metal filler wire **28** is fed by the pay-out reel **64** due to the action of the force of attraction produced by the rollers of guiding device **80**. It crosses the liquid solvent **74** filling the ultrasound bath **70**. In the course of this passage it is cleaned by ultrasound, the bath **70** is placed in ultrasonic vibration by a device, not shown, that is usual in systems of this type. The wire thus cleaned leaves the carriage **12** at the output of bath **70** by way of ring **82** and passes into the duct arranged for this purpose in the flexible shaft. It is advanced by the driving roller **80** gradually as it is used at its end **30** caused by the forming fusion of the weld. The ultrasound cleaning in the bath **70** causes a heating of liquid Freon **74**, which evaporates. The vapor is captured by the nozzle **86** and condensed on the inside of the coil pipe **92**, the chamber **52** being cooled by the operation of the compressor group 50. The condensate is returned by

the pump 98 to the top of the bath 70.

At the same time, the cooling chamber **52** recovers the calories /9 from the hot water aspirated by the pump **110** and forced into the coil pipe **106** before being sent, by the connector **120**, into the inside of the flexible shaft **16**. The water thus cooled runs through the spiral cooling duct **38** of the torch **36** and returns by way of connector **122** to the tank **124**.

In this way, functioning of the welding machine with a perfectly clean metal filler wire is obtained, the ultrasound carrying out a particularly effective cleaning of the wire surface. Under these conditions, the guiding duct of the wire on the inside of the flexible shaft **16** remains clean and the parts in contact with the latter do not become clogged with soil. In particular, the electrical contact is made under good conditions between the contact tube **26**, supplied from the current source, which is not shown, by the electrical conductors also passing through the flexible shaft **116**.

At the same time, a very effective cooling of the torch is ensured and, in the example shown, by making use of one and the same cooling unit. The torch can thus be used with very high amperage which can reach or exceed 800 amps. It can continue to function in a reliable manner for long periods of time without risk of burnout and while minimizing the breakage and other breakdowns in the regular advance of the metal filler water.

As regards the cooling of this torch, the invention also presents the advantage of being adapted very simply to torch cooling systems by

circulation of water that already exist. In comparison to the prior art, it makes it possible to obtain cooling that is even more efficient of the refrigerant liquid and do so in a manner that is almost silent. The welding unit assembly **10** forms a compact unit with high reliability.

The invention is applicable to any type of electrical welding /10
machine with metal filler wire, such as MIG (metal inert gas) machines, MAG (metal active gas) machines or TIG (tungsten inert gas) machines, for example. As regards the aspects of cooling itself, it is also applicable to other types of welding machines with torches, for example to plasma machines.

Naturally, the use of the invention can be the object of embodiment variations. It is thus notable that the trajectory of the metal filler wire into the inside of the ultrasound cleaning bath can have configurations other than those that are shown. In the same way, the shape of the ultrasound bath itself can be adapted as a function of the desired trajectory for the wire and the cleaning performance of same that is the goal.

Claims. /11

1. Electric welding machine of the type comprising a torch (18) making it possible to position one end (30) of a metal filler wire (28) and to cause its fusion by carrying out a weld (24) and a supply magazine (64) of metal filler wire, characterized by a processing means (70) for the surface of the metal filler wire (28) between the supply magazine (64) and the torch (18), in particular for carrying

out cleaning, dust removal, degreasing and/or deoxidizing.

2. Machine according to Claim 1, characterized in that the said processing means comprise an ultrasound cleaning device (70).

3. Machine according to Claim 2, characterized in that the ultrasound cleaning device comprises an ultrasound bath (70) filled with a liquid (74) in which the metal filler wire to be cleaned circulates and cooling means (50, 52, 92) for condensation of the vapor escaping from the ultrasound bath.

4. Machine according to Claim 3, characterized by ducts to circulate a refrigerant liquid in the torch (18), these ducts (118, 126) being connected to the said cooling means (50, 52) for the cleaning liquid vapor to cool the refrigerant liquid of the torch.

5. Machine according to Claim 4, comprising a soldering unit (12) on which the supply magazine (64) is mounted, characterized in that the ultrasound cleaning device (70) is mounted at the output of the supply magazine with its cooling means (50, 52) connected to this unit, this unit (12) being connected to the torch by a flexible shaft (16) comprising guiding means for the metal filler wire (28) at the outlet of the ultrasound cleaning device and two pipes for supply /12 and return circulation of the refrigerant liquid of the torch, these pipes extending to the inside of the unit by a cooling coil pipe (106) into a chamber (52) of the said cooling means.

6. Device for cooling a welding torch comprising the circulating ducts for refrigerant liquid in the torch and means for connecting these ducts to a cooling unit with refrigerant liquid coming from the

torch before returning to it, characterized in that this cooling unit comprises a cold production group (50) comprising a cooling chamber (52) in which an exchanger duct (106) and the means (110) to circulate the refrigerant liquid in this duct are installed.

2536320

1/1